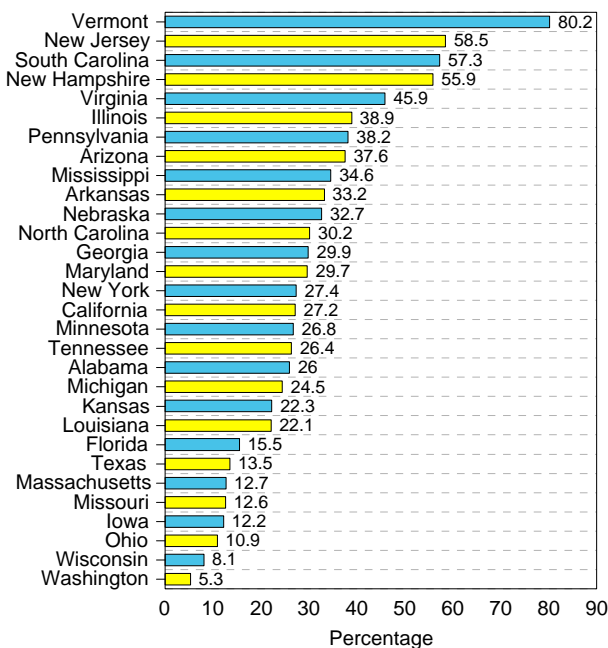


Nuclear Energy Plant Optimization

Background

Among the baseload electricity generation options available today, only nuclear power plants can provide large supplies of reliable baseload electricity without contributing to regional air pollution or global greenhouse gas emissions. The continued operation of the nation's 104 nuclear power plants can provide a reliable, economical source of energy during this period of uncertain change as the electric utilities transition to a fully deregulated industry. These power plants provide approximately one-fifth of the nation's electricity with nearly one-half of the 50 states receiving more than a quarter of their electricity from nuclear power. Further, in many regions of the nation, the loss of nuclear power plants would not only have negative environmental impacts, but also threaten the reliability of several states' electric generation system.

Nuclear Electricity Generation by State in 1997

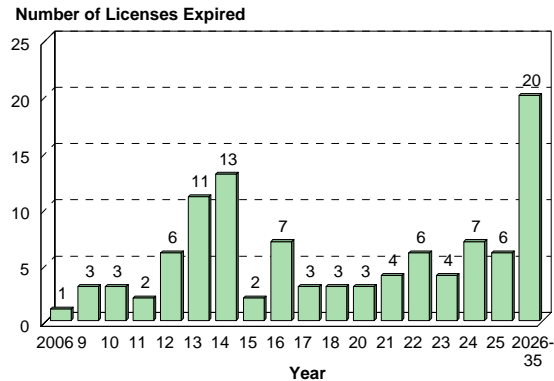


Source: EIA 1999

In the last three years six nuclear units have been shut down prematurely. According to the Energy Information Administration's (EIA) 1999 Annual Energy Outlook, 27 more nuclear units are projected to retire prior to expiration of their operating licenses by 2020. If no action is taken, then by 2020, EIA predicts U.S. nuclear generation will drop to 50 percent of current levels and nuclear generating capacity share will drop by 67 percent!

Recognizing the importance of extending the service lives of existing U.S. nuclear plants, the Energy Research and Development Panel of the President's Committee of

U.S. Commercial Nuclear Power Reactor Operating Licenses
Expiration by Year



Advisors on Science and Technology (PCAST) recommended that "DOE work with its laboratories and the utility industry to develop a program to address the problems that may prevent the continued operation of current nuclear plants." The Department believes that advanced technologies can have a significant impact on EIA's projections and enable a large number of nuclear plants to continue operating into the middle of the next century.

PCAST also recommended that Department establish a new nuclear energy research effort to address the key issues affecting nuclear energy's potential as a future energy source. The Department responded to the PCAST recommendations and proposed the *Nuclear Energy Plant Optimization* (NEPO) program in coordination with the Electric Power Research Institute (EPRI) and the *Nuclear Energy Research Initiative* (NERI) for FY 99. Congress approved \$19 Million for the NERI program in FY 99 but denied funding for NEPO. The Department believes both these programs to be very important to its mission and therefore both are included in the budget request for 2000.

Although both NERI and NEPO are based on PCAST recommendations and will be guided by the Nuclear Energy Research Advisory Committee (NERAC), the Department proposed the two programs separately because the focus of each program and the process for selecting and funding the research are different. NERI will fund investigator initiated research by selecting proposals from universities, national laboratories, and industry through a competitive and peer-reviewed selection process. It focuses on resolution of issues facing the future of nuclear power and will sponsor research which is innovative, high-risk and long-term in nature. NEPO, on the other hand, is a cooperative and

cost-shared program with the industry. It would fund evolutionary, mid-term, critical research and development which is recognized to be required for current nuclear power plants but is not currently planned or being conducted because of inadequate market incentive to conduct research that is of high economic risk or is not plant specific.

To guide all future work for NEPO, the Department and EPRI have developed a *Joint DOE-EPRI Strategic Research and Development Plan to Optimize U.S. Nuclear Power Plants* which identifies and prioritizes the critical R&D that industry will not address on its own. This plan has been widely reviewed and endorsed by experts in industry, universities, the Nuclear Regulatory Commission (NRC), and national laboratories. This plan identifies the technologies needed to address the critical issues associated with the continued operation of current nuclear plants and its implementation would provide a foundation for U.S. electric utility companies to plan for the long-term operation of their nuclear plants. This plan defines the DOE and industry cost-shared roles for this public-private cooperation. It also defines roles of NRC and other government agencies as well as the need for international collaborations to leverage limited resources.

The goal of NEPO is to develop and demonstrate technologies that can enhance safe, reliable, and economic

operation of U.S. nuclear power plants through their current and renewed license terms. The Department has established the following objectives to achieve this goal:

- Manage the long-term aging effects for key nuclear plant components including steam generators, reactor vessel internals, and electrical cables.
- Improve nuclear power plant reliability and productivity through development of advanced technologies in digital instrumentation, remote sensors, systems diagnostics, and plant data acquisition and management.

FY 2000 Planned Accomplishments

- Develop data to verify the dose-rate and temperature effects models used for assessing long-term artificial aging of cables.
- Resolve key technical issues necessary for NRC to issue draft Safety Evaluation Report (SER) for first license renewal application.
- Demonstrate the feasibility of using micro-machines as mechanical interlocks on digital systems.

| Program Budget (in millions) | | |
|---------------------------------|---------------------------------|---------------------------|
| FY 1998 <u>Appropriation</u> | FY 1999 <u>Appropriation</u> | FY 2000 <u>Request</u> |
| \$0.0 | \$0.0 | \$5.0 |